Volume 2, Issue 5 ■ 03FEB2012

S&T NEWS BULLETIN

THE LATEST IN SCIENCE AND TECHNOLOGY RESEARCH NEWS

Feature Articles

Graphene: The Ultimate Switch

IEEE Spectrum, 30JAN2012

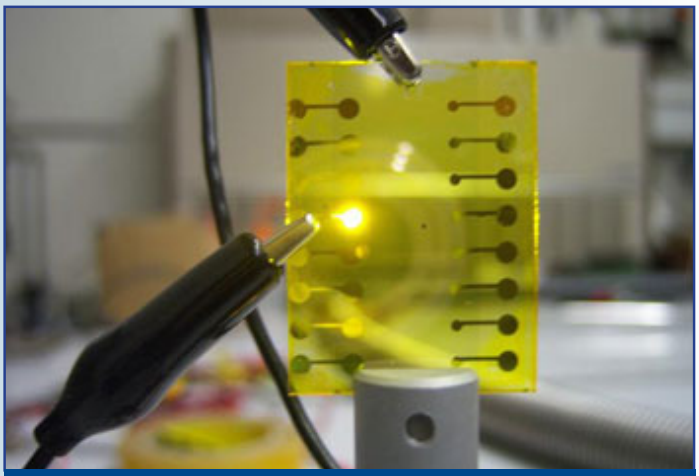
After 50 years of steady miniaturization, chipmakers have just about shrunk the device to its limits. The future gets hazy beyond 2020, but we know that to continue making faster, cheaper, and more energy efficient chips, we'll need a new technology. Graphene could replace the transistor with switches that steer electrons just like beams of light. Graphene logic will be extraordinarily fast, consume less power and take up far less real estate than CMOS or optical switches. Graphene devices have the potential to simplify and speed up chips by creating truly reconfigurable logic. Nanoelectronics Research Initiative

Tags: Advanced materials, Nanomaterials, Featured Article

Physicists develop single-photon emitting light source

Nanowerk, 26JAN2012

Physicists in Germany have made significant progress in the fabrication of such structures. The innovative light source has more than just one advantage: It consists of standard materials for organic light-emitting diodes, is pretty easy to manufacture and can be electrically controlled. What's most important: It works at room temperature. So far, any comparable optical components manufactured from semiconductor materials, such as gallium arsenide, are only functional at temperatures far below the freezing point. Such light sources are a basic requirement for the development of new encryption technologies. TECHNICAL ARTICLE: Maximilian Nothaft, ET. AL. "Electrically driven photon antibunching from a single molecule at room temperature" Nature Communications 3, 17 January 2012, Article number: 628 doi:10.1038/ncomms1637



The innovative component with which single photons can be produced at room temperature shown in action. Electric current passes through the circular contacts, stimulating the underlying color molecules to light up. The optically active area of the component is about two millimeters in diameter. (Photo: Benedikt Stender)

Tags: Photonics, Communications Technology, Foreign S&T, S&T Germany, Featured Article

S&T News Articles

ADVANCED MANUFACTURING

Will 3D printers lead toward nanofactories?

Foresight Institute, 29JAN2012

The coming era of atomically precise manufacturing will provide digital control of the structure of matter for a very wide range of possible products and will make possible personal manufacturing of most products.

Tags: Advanced manufacturing, Advanced materials

ADVANCED MATERIALS

Nano-tornadoes help overcome the limitations of nanoplasmonics (w/video)

Nanowerk, 31JAN2012

Despite offering technological innovation in biosensing and THz metamaterials design, plasmonics faces fundamental physical limitation in the visible frequency band due to high absorptive losses of metals. Researchers at Boston University demonstrate a new way to efficiently trap, enhance and manipulate light in nanoscale structures and nanopat-

continued...

BACK TO TOP

terned thin films. This novel approach can significantly improve performance of photonic and electronic devices.
Tags: Advanced materials, Photonics

No future without scarce metals
Nanowerk, 31JAN2012
Empa (Switzerland) researchers and representatives from industry explained at the Technology Briefing why scarce metals are essential for many key technologies and how an impending scarcity might be avoided. Raw materials which can only be mined and refined in a few countries, for which alternatives are not easy to find and which have a low rate of recycling, are considered critical. China, for example, almost completely controls the supply of rare earth metals from which high-performance permanent magnets are manufactured.
Tags: Advanced materials

Microscopy reveals 'atomic antenna' behavior in graphene
Nanowerk, 30JAN2012
Atomic-level defects in graphene could be a path forward to smaller and faster electronic devices, according to a study led by researchers at the Department of Energy's Oak Ridge National Laboratory. In this proof of concept experiment, they have shown that a tiny wire made up of a pair of single silicon atoms in graphene can be used to convert light into an electronic signal, transmit the signal and then convert the signal back into light.
Tags: Advanced materials

Take Nanocrystals, Add Boiling Water, and Get a 400-Fold Increase in Luminescence
IEEE Spectrum, 30JAN2012
By heating these nanocrystals to 100 degrees Celsius, it is possible to remove the impurities and increase their luminescence by 400-fold within 30 hours. When the impurities were removed the optoelectronic properties of nanocrystals made through cation-exchange were comparable in quality to dots and nanorods conventionally synthesized.
Tags: Advanced materials, Nanomaterials

X-Ray Laser Turns Up the Heat to 3.6 Million Degrees
Wired, 25JAN2012
By focusing rapid-fire pulses from the beam on a piece of aluminum foil thinner than spider's silk, researchers were able to create a material known as hot dense matter. Hot dense matter is some of the most extreme material in the universe, only existing in the hearts of stars and giant gas planets. Having a sample of it in the lab should provide insights into the material, helping scientists to create better models of its behavior.
Tags: Advanced materials, Materials science

AUTONOMOUS SYSTEMS & ROBOTICS

Cute Little Drone Could Soar Through the Skies of Saturn's Moon Titan
IEEE Spectrum, 30JAN2012
The overall idea is that instead of a lander or a rover, AVIATR would be a little 120-kilogram airplane driven by an electric propeller, with a big antenna for talking to Earth in its nose and a hefty science payload in its body. In flight, AVIATR would be able to cover the entire surface, with much more precision, detail, and versatility than an orbiter.
Tags: Autonomous systems & robotics, Government S&T, NASA

DARPA-funded hacker's tiny $50 spy computer hides in offices, drops from drones
KurezweilAI, 30JAN2012
The F-BOMB (Falling or Ballistically launched Object that Makes Backdoors), built from just the hardware in a commercially available $25 PogoPlug mini-computer, a few tiny antennas, 8GB of flash memory, and some 3D-printed plastic casing, the F-BOMB serves as 3.5x4x1 inch spy computer. It can be plugged inconspicuously into a wall socket, thrown over a barrier, or otherwise put into irretrievable positions to quietly collect data and send it back to the owner over any available Wi-Fi network.
Tags: Autonomous systems & robotics, DARPA

BIOTECHNOLOGY

Military Masks Could 'Give Injured Soldiers Their Faces Back'
Wired, 30JAN2012
The mask will be comprised of two major layers. The top, a hard shell, will protect a patient's face and also store electrical components. Underneath, a flexible polymer mask will fit around the contours of a patient's face. It'll be embedded with three more layers: An array of sensors to track the rate of healing, actuators to push up against the wound and hold the mask in place, and a network of micro-tubing and valves to pump therapeutics—whether antibiotics and pain killers or stem cells and growth factor—onto specific regions of the wound. Right now, the mask is in early stages of development at UT Arlington.
Tags: Biotechnology, Military technology

COMMUNICATIONS TECHNOLOGY

Research at Rice University leads to nanotube-based device for communication, security, sensing
EurekAlert, 30JAN2012
The polarizer developed by the Rice University researchers is the most effective ever reported; it selectively allows 100 percent of a terahertz wave to pass or blocks 99.9 percent of it, depending on its polarization.
Tags: Communications Technology, Nanomaterials

continued...

"If you thought that science was certain — well, that is just an error on your part." RICHARD FEYNMAN

CYBER SECURITY

The intruder in your computer

DoDBuzz.com, 24JAN2012

If you get a legitimate-looking PDF attachment in your email—especially if you work in the Building or anywhere in the government—think twice before you open it. That attachment could contain a virus that could, among other things, capture the passcode or other information associated with your Common Access Card. It is suspected that the cyber attack originates from China because of the Chinese characters found within the virus' coding. They found software that's only really used in China.

Tags: Cyber security, China

ELECTRONIC WARFARE

New EW Capabilities To Emerge With NGJ

Aviation Week, 27JAN2012

Technologies being offered up by the aerospace industry for the Next Generation Jammer (NGJ) are still closely held, but clues are emerging. The advanced technologies include techniques to make segmented arrays work while minimizing co- or cross-channel interference. One solution involves developing receivers/exciters with lower harmonics. In addition, there is already work ongoing to use an aircraft's skin as antennas.

Tags: Electronic Warfare, Military technology

ENERGY

Indoor solar cells (w/video)

Nanowerk, 30JAN2012

Sometime soon our lives may be powered by this new kind of solar cell—known as dye-sensitised cells—that can generate electricity from indoor light. Rather than working like the normal photovoltaics does, these behave very much like photosynthesis, so it mimics the way a plant works. We take a metal foil, we coat that with titanium dioxide, we then add and stain the titanium dioxide with a dye, finally we add an electrolyte, and we finish the whole set off with a transparent conducting counter electrode.

Tags: Energy, Solar energy

Minirailguns for commercial nuclear fusion update

Next Big Future, 30JAN2012

HyperV Technologies is trying to develop minirailguns for the world's first commercially viable fusion reactor technology. Their research could result in the development of a controlled hot fusion reactor that is scalable to provide between 100 MW and 2,000 MW of clean base load electric power.

Tags: Energy, Nuclear energy

Astrowatt's wafer-making method could mean cheaper solar power

MIT Technology Review, 25JAN2012

Conventional solar manufacturing requires sawing a block of crystalline silicon into wafers about 180 micrometers thick. As the saw cuts through the silicon, it turns almost the same amount of silicon (a layer 100 to 150 micrometers thick) into sawdust that can't typically be reused. With the conventional process, a millimeter of silicon can produce about three solar-cell wafers. Astrowatt says it can make five or more wafers from the same amount of material by mostly replacing the sawing with a technique that allows it to peel thin layers of silicon away from a thick silicon wafer.

Tags: Energy, Solar energy

EXPLOSIVES

Sandia's self-guided bullet prototype can hit target a mile away

Sandia National Laboratory, 30JAN2012

Sandia researchers have invented a dart-like, self-guided bullet for small-caliber, smooth-bore firearms that could hit laser-designated targets at distances of more than a mile (about 2,000 meters).

Tags: Explosives, Government S&T, Military technology

GOVERNMENT S&T

DARPA is developing virtual reality contact lenses

Nanowerk, 31JAN2012

Currently being developed by DARPA researchers at Washington-based Innovega iOptiks are contact lenses that enhance normal vision by allowing a wearer to view virtual and augmented reality images without the need for bulky apparatus. Developed as part of DARPA's Soldier Centric Imaging via Computational Cameras (SCENICC) program, SCENICC's objective is to eliminate the ISR capability gap that exists at the individual Soldier level.

Tags: Government S&T

Joint Operational Access Concept (JOAC)

Defense News, 01JAN2012

This paper proposes a concept for how joint forces will achieve operational access in the face of armed opposition by a variety of potential enemies and under a variety

continued...

of conditions, as part of a broader national approach. The concept identifies 30 operational capabilities the future joint force will need to gain operational access in an opposed environment, in the area of Command and Control, Intelligence, Fires, Movement and Maneuver, Protection, Sustainment, Information, and Engagement.
Tags: Government S&T, Military technology

INFORMATION TECHNOLOGY

Spin-Sensitive Optics

American Physical Society, 23JAN2012
Magnetic switching is the basis for numerous applications, such as the processing and storage of information on magnetic media. Magnets are typically polarized or switched by a magnetic field pulse. Researchers in the US have confirmed that optical pulses do indeed demagnetize a ferromagnetic nickel film. Their new method enhances a reliable technique for probing the way spins respond to ultrafast optics, which will become increasingly useful in the development of high-speed, spin-based applications.
Tags: Information Technology

Featured Resource

Kurzweil AI

The "AI" in KurzweilAI refers to "accelerating intelligence," a core concept that underlies the exponential growth of the pervasive information-based technologies, both biological and machine. The leading visionaries represented on this site cover these and other topics, and examine the trends that are profoundly impacting science, warfare, medicine, and society. RSS

MATERIALS SCIENCE

Oxygen molecule survives to enormously high pressures

EurekAlert, 30JAN2012
Using computer simulations researchers have shown that the oxygen molecule is stable up to pressures of 1.9 terapascal, which is about nineteen million times higher than atmosphere pressure. Above that, it polymerizes, i.e. builds larger molecules or structures. Polymerization of small molecules under high pressure has attracted much attention because it helps to understand the fundamental physics and chemistry of geological and planetary processes.
Tags: Materials science

QUANTUM SCIENCE

Heating cools a semiconductor

Physics World, 31JAN2012
Laser cooling has been used on a solid film of semiconductor for the first time, reducing its temperature to a chilly 4 K. The work has been done by researchers in Denmark, who suggest that with future developments the semiconductor's temperature could be chilled further so that its vibrations are reduced almost to the quantum ground state in at least one direction. This would allow the semiconductor to sense the slightest of mechanical motions or tiny electrical currents.
Tags: Quantum science, Photonics

Quantum physicists shed new light on relation between entanglement and nonlocality

PhysOrg.com, 30JAN2012
New research from the University of Bristol may disprove a long-standing conjecture: that quantum states featuring "positive partial transpose," a particular symmetry under time-reversal, can never lead to nonlocality. This work raises novel questions in quantum information science. In particular, it will spark a debate on the role that entanglement and nonlocality play in quantum information processing tasks, such as in quantum cryptography and computation.
Tags: Quantum science, Cryptology

Serious Flaw Emerges In Quantum Cryptography

MIT Technology Review, 25JAN2012
While quantum key distribution offers perfect security in practice, the devices used to send quantum messages are inevitably imperfect. For example, lasers that are supposed to send one photon at a time can sometimes send several and this allows information to leak to an eavesdropper. The protocols treat quantum cryptography as a single-shot process, as if the equipment is used only once. The question researchers consider is what tricks could a malicious manufacturer exploit in a device that is likely to be used more than once.
Tags: Quantum science, Communications Technology, Cryptology

SCIENCE WITHOUT BORDERS

IR Eye

IEEE Spectrum , 31JAN2012
The Cheap Thermocam is the brainchild of two 18-year-old students, Max Ritter and Mark Kohl, from Mindelheim, Germany. The project earned them an award in the 2010 Jugend Forscht, the largest science and technology competition for young people in Europe. Ritter has a website where he documents what is needed to build the device, including sources for virtually all the required components.
Tags: Science without borders

continued...

Scientists build working model of life's engine

PhysOrg.com, 31JAN2012

Researchers at the University of Southern California have built a theoretical working model of the cellular engine that powers all life. They built a computer-generated model of F1-ATPase that was remarkably successful at replicating the essential physical forces underlying the workings of the engine, mirroring the cellular motor's unique unidirectional rotation.

Tags: Science without borders, Biology

Sweat, tears lead to breakthrough

PhysOrg.com, 31JAN2012

A UCI team has succeeded in tethering a single protein molecule found in human teardrops to the world's smallest electronic circuit—embedded in a tiny chip—letting scientists "listen in" on it. The technique could eventually be adapted to detect single cancer molecules.

Tags: Science without borders

Desalination Battery

Next Big Future, 30JAN2012

We demonstrate the novel concept of a "desalination battery", which operates by performing cycles in reverse. Rather than generating electricity from salinity differences, as in mixing entropy batteries, desalination batteries use an electrical energy input to extract sodium and chloride ions from seawater and to generate fresh water. We demonstrate an energy consumption of 0.29 Wh l–1 for the removal of 25% salt using this novel desalination battery, which is promising when compared to reverse osmosis (0.2 Wh l–1), the most efficient technique presently available.

Tags: Science without borders

UCLA astronomers solve mystery of vanishing electrons

Brightsurf, 30JAN2012

To resolve the mystery of the missing electrons swept away from the planet by a tide of solar wind particles during periods of heightened solar activity, researchers used data from three networks of orbiting spacecraft positioned at different distances from Earth to catch the escaping electrons in the act. The data show that while a small amount of the missing energetic electrons did fall into the atmosphere, the vast majority were pushed away from the planet. A greater understanding of Earth's radiation belts is vital for protecting the satellites we rely on for global positioning, communications and weather monitoring.

Tags: Science without borders

MIT's folding car could revolutionize city driving, but it'll take some getting used to

Digital Trends, 27JAN2012

A concept car from MIT Media Labs has become a reality. The electric Hiriko city car folds down into tight parking places and is very maneuverable, but will need some practice on the driver's part in order to make the most of its abilities. While it has been a concept for several years, a production model was unveiled in Brussels this week, all ready for its debut in Spain next year.

Tags: Science without borders

The TV on Your Shirt

MIT Technology Review, 27JAN2012

Wearable electronics gets a new boost, with a new platform from Adafruit Industries, the brainchild of DIY-goddess Limor Fried (hacker handle: Ladyada). The new platform, dubbed the Flora, points to a future where people are wearing TV screens—or at least, something vaguely like them—on their T-shirts.

Tags: Science without borders, Information technology

Report says journals remain "the gold standard" for disseminating results

Physics World, 26JAN2012

Physical scientists use and access information in very different ways depending on the precise field they work in, according to a report entitled Collaborative Yet Independent released today in UK. The report is based on interviews with 51 researchers and focus-group sessions with 35 participants in seven different fields. Google Scholar, for example, is used by 73% of Earth scientists and by 70% of nanoscientists to discover new research findings, but by just 13% of particle physicists and 7% of astrophysicists.

Tags: Science without borders, STEM

DARPA Developing Novel New Fire Suppression Method

DARPA, 20JAN2012

DARPA's Instant Fire Suppression (IFS) program, which ended recently, sought to establish the feasibility of a novel flame-suppression system based on destabilization of flame plasma with electromagnetic fields and acoustics techniques. The DARPA research team at Harvard University has demonstrated suppression of small methane and related fuel fires by using a hand-held electrode, or wand.

Tags: Science without borders, DARPA

SENSORS

Using Lasers to Find Land Mines and IEDs

IEEE Spectrum, 31JAN2012

Researchers at Princeton University propose to find and identify such materials at a distance by using a laser to sample the spectroscopic fingerprints of trace gases in a distant volume of air. They use two complementary techniques to probe that volume of air: one involving a backward-propagating laser generated in the air sample itself, and the other a radar echo off ions and electrons from trace gas molecules that have been selectively ionized by a laser.

Tags: Sensors, Military technology

continued...

Periodic patterning confines light, claim physicists

Physics World, 26JAN2012

Physicists in Spain and the UK have calculated that Graphene could be used to create a perfect absorber of light if it is doped and patterned into a periodic array. The work could lead to improved light-detection devices, particularly in the infrared part of the electromagnetic spectrum.

Tags: Sensors, Military technology

STEM

How to Make Science and Tech Jobs More Enticing to Undergrads

Scientific American, 01FEB2012

The number of U.S. undergraduate degrees being awarded in most STEM disciplines has risen steadily in recent years. Yet some American employers say they are having trouble finding candidates to fill STEM jobs. The mismatch is not occurring because of an actual shortage of graduates. The mismatch is occurring because people with STEM degrees are choosing jobs in other fields that pay more or have higher perceived status.

Tags: STEM

Japan plans to merge major science bodies

Nature News, 01FEB2012

In its battle against a sluggish economy, Japan's government is gearing up to make cost savings through a root-and-branch reform of the country's science system, merging some of its most prominent research organizations. But with few details about the timing, potential cost savings or full implications of the change, many researchers are concerned that it could be a recipe for harsh funding cuts and even greater bureaucracy.

Tags: STEM, Science without borders ■

About This Publication

The appearance of external hyperlinks in this publication does not constitute endorsement by the United States Department of Defense (DoD) of the linked web sites, nor the information, products or services contained therein. In addition, the content featured does not necessarily reflect DoD's views or priorities.

To subscribe (or unsubscribe), visit https://tin-ly.sainc.com/ASDRE. To provide feedback or ask questions, contact us at asdre-st-bulletin-reply@sainc.com.

This publication is authored and distributed by:

Dr. Melissa Flagg
Director, Office of Technical Intelligence (OTI)

Ms. Hema Viswanath
OTI Corporate Librarian